

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPLICANT(s): Kaikuranta et al.

SERIAL NO.: 09/847,142

ART UNIT: 2635

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EXAMINER: Wong, A. K.

TITLE: KEYPAD ILLUMINATION ARRANGEMENT THAT ENABLES
DYNAMIC AND INDIVIDUAL ILLUMINATION OF KEYS
AND METHOD OF USING THE SAME

ATTORNEY

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BOARD OF PATENT APPEALS AND INTERFERENCES
Commissioner of Patents
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APPELLANTS' BRIEF

This is an appeal from the final rejection of the claims in the above-identified application. A Notice of Appeal was mailed on 16 November 2004.

I. REAL PARTY IN INTEREST

The real party in interest in this Appeal is:

Nokia Mobile Phones Ltd.

Keilalahdentie 4, FIN-02150 ESPOO, Finland

II. RELATED APPEALS AND INTERFERENCES

There are no directly related appeals or interferences regarding this application.

III. STATUS OF CLAIMS

Claims 1-29 are pending in the application.

Claims 1-29 have been finally rejected.

The claims on appeal are 1-29.

IV. STATUS OF AMENDMENTS

There are no unentered amendments.

V. SUMMARY OF CLAIMED SUBJECT MATTER

In one embodiment, the present invention is directed to a keypad for a mobile phone. As shown in Figure 4, and described on page 6, lines 21-34, the keypad includes a number of pressable keys 402 and an illumination means shown as an OLED Light Source for illuminating at least a part of the keypad. A switching means in space 403 is associated with each key for realizing a switching function as a response to the key being pressed. The switching means is described on page 6, lines 30-32 as, for example, an assembly of conductive strips.

The illumination means includes light sources that are semiconductor light-emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of the keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects.

Figures 8, 9, and 10 as described on page 9, lines 1-35 describe aspects of the invention for illuminating keys or key groups for different types of effects. At least one of the light sources is located in the immediate vicinity of the switching means associated with at least one key, as described on page 6, line 35 through page 8, line 6, and shown in Figures 5 and 6a-6c. The light sources constitute at least a first group and a second group, where the first and second groups of light sources are arranged to be illuminated separately from each other as shown in Figures 8, 9, and 10 as described on page 9, lines 1-35.

The light sources may be organic light-emitting diodes as described on page 6, lines 32-34.

In another embodiment, the present invention includes a method for illuminating the keys of a keypad of a mobile phone. The method includes providing light sources that are semiconductor light-emitting devices made of layered foil structures as an illumination means for dynamically illuminating individual keys or key groups of the keypad, as described on page 6, lines 21-34, and shown in Figure 4. Page 9, lines 1-35 in combination with Figures 8, 9, and 10 describe how the keys or key groups are dynamically illuminated in such a way that the illumination means is reconfigurable for different kinds of illumination effects. The method also includes producing, with at least one of the light sources, an illuminating effect where at least one key is illuminated differently than certain other keys in the keypad, as described, for example, on page 13, line 30 through page 14, line 4.

In yet another aspect of the embodiment shown in Figure 4 and described on page 6, lines 21-34, the present invention is

directed to a keypad for a mobile phone having a mechanical support structure 401, a plurality of keys 402, and a layer 403 including a switching function and a layered foil illumination structure for each of the plurality of keys, integrated together.

In a further embodiment, the present invention is directed to a mobile phone having a keypad, where the keypad includes a mechanical support structure 401, a plurality of keys 402, and a layer 403 including a switching function and a layered foil illumination structure for each of the plurality of keys, integrated together, as described on page 6, lines 21-34 and shown in Figure 4.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1-7, 11, and 16 stand rejected as unpatentable over the combination of Thornton (US 5,847,336) in view of Stanek (US 5,936,554) under 35 U.S.C. 103(a).
2. Claims 8 and 9 stand rejected as unpatentable over the combination of Thornton, Stanek, and JP 11-126047 under 35 U.S.C. 103(a).
3. Claim 10 is rejected as unpatentable over the combination of Thornton, Stanek, JP 11-126047, and JP 11-327509 under 35 U.S.C. 103(a).
4. Claims 12-15 stand rejected as unpatentable over the combination of Thornton, Stanek, and JP 08-148056 under 35 U.S.C. 103(a).

5. Claim 17 is rejected as unpatentable over the combination of Thornton, Stanek, and JP 08-265413 under 35 U.S.C. 103(a).

6. Claim 18 is rejected as unpatentable over the combination of Thornton, Stanek, and JP 06-274261 under 35 U.S.C. 103(a).

7. Claims 19 and 20 stand rejected as unpatentable over the combination of Thornton, Stanek, and JP 11-88948 under 35 U.S.C. 103(a).

8. Claims 21-25 stand rejected as unpatentable over Stanek under 35 U.S.C. 103(a).

9. Claims 26-28 stand rejected as unpatentable over the combination of Stanek, Uggmark (US 6,222,466), and Thornton under 35 U.S.C. 103(a).

10. Claim 29 is stand rejected as unpatentable over Stanek under 35 U.S.C. 103(a).

VII. ARGUMENT

1. Claims 1-7, 11, and 16 are patentable over the combination of Thornton (US 5,847,336) in view of Stanek (US 5,936,554).

1.1. The combination of Thornton and Stanek fails to disclose a keypad for a mobile phone with light sources that are semiconductor light emitting devices made of layered foil structures, as recited by claims 1 and 16.

The present Office Action correctly points out that Thornton fails to disclose devices made of layered foil structures. Stanek also fails to disclose or suggest such devices. Because neither reference discloses light emitting devices, the cited

combination cannot disclose or suggest all the features of the invention as claimed.

Applicants respectfully submit that semiconductor light emitting devices made of layered foil structures are not obvious at all when considering the cited art. Applicants submit that the conclusion of obviousness in this case is based on impermissible hindsight because it requires knowledge gleaned only from Applicants disclosure. There has been no reference cited that discloses semiconductor light emitting devices made of layered foil structures used in the same way as the present invention.

Applicants disagree with the Examiner's argument that it would have been obvious to substitute a conventional LED for an OLED because they perform the same function. Nevertheless, replacing the layered foil structure devices of the present invention with the conventional LED's of Thornton clearly yields a keypad that has no light emitting devices with layered foil structures.

Thus, the combination and arguments presented by the Examiner not only fail to include all the features of the claimed invention, but explicitly exclude the claimed feature of layered foil structures. Therefore, the cited combination cannot render the present invention unpatentable.

Thornton illustrates a conventional technical solution for key illumination using separate light sources (LEDs) for each individual key. The layered foil structure of the present invention is not even implicitly disclosed, in fact, Thornton provides teachings to the contrary by specifying individual LEDs.

Thornton is based on mid 1990's mobile phone illumination technology that typically included 15-20 LEDs for keypad area illumination, where each LED typically consumed approximately 20 mA of current. This type of power consumption is no longer feasible in today's environment where power consumption requirements are very low.

Stanek also has no disclosure related to light sources made of layered foil structures. Stanek only discloses PC computer keyboards with illumination mechanics and a structure strictly tied to LEDs. Stanek's PC's have a stable and strong power source, the fixed power line from the electric network and therefore have no requirement for reduced power consumption.

In contrast, the present invention is limited specifically to a keypad for a mobile phone and teaches a novel implementation of key illumination principles that not only improves usability but also provides additional functionality that may be used with non-standard applications, such as games.

Applicants disagree with the Examiner's argument that it would have been obvious to include a means to effect such illumination controls for the reasons stated in column 8 of Stanek. Column 8 includes the statement common to nearly every patent application, that the scope of the patent is not limited to the disclosed examples, but can be used with many "changes and modifications," and may include "other manners of key illumination" without departing from the scope of the claims. Regardless, the combination of Stanek and Thornton fails to disclose or suggest all the claim limitations of the present invention and therefore does not render claims 1 and 16 obvious.

The present invention provides a beneficial, cost efficient technical solution for mobile phone keypad functionality that advantageously supports mass manufacturing, low power consumption, thin phone structures, and easy configuration for key illumination. Moreover, the illumination is not necessarily tied to or associated with keys, individual keys, or a display. Additional effects may be provided for games and animation sequences.

The Applicants have realized the advantageous use of layered foil structures for portable device keypad illumination, which provides additional flexibility for implementing functions and device operations. The improved functionality of the portable device and keypad is not dependent on keys or a display but is related to layered foil structures.

For these reasons, the combination of Thornton and Stanek fails to disclose or suggest all the features of claims 1 and 16.

In addition to failing to disclose or suggest all the limitations of the claims, the combination of Thornton and Stanek fails to render claims 1-7, 11, and 16 unpatentable for at least the following reasons:

The cited art is different and too remote

Thornton relates to illumination of a keypad explicitly using separate LEDs for each key. Thornton illustrates a conventional technical solution for key illumination using separate LEDs for each individual key.

While the present invention of claim 1 explicitly recites "a keypad for a mobile phone," the recited mobile phone keypad

includes layered foil structures for dynamic illumination. While OLEDs are layered foil structures, they are technically far removed from the cited references as such. Furthermore, none of the references disclose or suggest utilizing OLEDs with a mobile phone keypad. The suggestions of such a relationship is completely missing from the cited art.

Stanek relates to PC computer keyboards.

Thus, there are three separate and different technical fields of art present. However, they are too remote from each other, have no binding technical features, and have completely different disclosures, all of which preclude their combination. The skilled person would not look other references when starting from any of the cited references.

There is no reasonable expectation of success when combining the references.

There are inherent incompatibilities with the features essential to the present invention:

The PC keyboard of Stanek does not fit a mobile phone because it is simply too big.

The PC computer of Stanek has no relation to a mobile phone.

The mobile phone is portable, quite small and light, and has a wireless connection.

Thornton's LED based keypad structure is inappropriate for using OLEDs because the design the structure of the keypad mechanics shown in Figures 4, 6, 3 and 1 of Thornton is

incompatible with OLED based layer structures. The LED (18) of Thornton is not replaceable with OLED technology. This would require significant modification of the keypad mechanics, and the instructions are missing, that is, there is no disclosure regarding how this would be accomplished.

Thornton's LED based keypad illumination and mechanics cannot be integrated with OLED technology to achieve "a layer including a switching function and layered foil illumination structure for each of the plurality of keys, integrated together" as in the present invention. Thornton's disclosure and the subject of OLED technology relate to two separate fields of endeavor. Such a combination would require significant modification of the keypad mechanics of Thornton, and there is no disclosure or suggestion of how to accomplish this. A combination utilizing Stanek's PC keyboard is out of the question because the keyboard is absolutely too large to substitute for the keypad of Thornton.

The skilled person would not be motivated to make the combination.

As mentioned above, Thornton's disclosure and the subject of OLEDs relate to two separate fields of endeavor. Such a combination would require significant modification of the keypad mechanics of Thornton, and there is no disclosure or suggestion of how to accomplish this. A combination utilizing Stanek's PC keyboard is out of the question because the keyboard is absolutely too large to substitute for the keypad of Thornton.

Thus, Thornton presents no incentive or motivation for the skilled person to replace the LED's with anything else. To the contrary, Thornton's teachings are tightly related to solutions based on individual LED's and related keypad mechanics. These facts actually reduce or negate any motivation to utilize OLEDs.

There is no disclosure in Stanek related to replacing LEDs with a layered structure. The last sentence of column 8 tries to vaguely broaden the means for key illumination but even that portion of Stanek fails to disclose why or how to make the layered structure and mobile phone combination. The sentence in column 8, line 65-66 that "[h]owever, the invention [of Stanek] could utilize other manners of key illumination without departing from the scope of the claims" cannot represent such an incentive or motivation without additional information.

Thus, Stanek fails to provide any incentive or motivation for a skilled person to replace the LED with anything else. Neither does it give instruction as to why nor how to replace the keyboard of the PC. To the contrary, the teachings of Stanek are tightly related to the individual LED based solution and PC keyboard mechanics of the structures disclosed therein. The disclosure of Stanek serves to teach away from any combination that includes OLEDs.

For these reasons, a skilled person would find no motivation or suggestion to combine Thornton and Stanek to arrive at the present invention.

1.2. At least for these reasons, Applicants respectfully submit that claims 1 and 16 are patentable over the combination of Thornton and Stanek.

1.3. Claims 2-7 and 11 depend from claim 1 and therefore are also patentable over the combination of Thornton and Stanek.

2. Claims 8 and 9 are patentable over the combination of Thornton, Stanek, and JP 11-126047.

Claims 8 and 9 depend from claim 1.

Like Thornton and Stanek, JP 11-126047 fails to disclose or suggest light sources that are semiconductor light emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of a keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects, as recited by claim 1.

3. Claim 10 is patentable over the combination of Thornton, Stanek, JP 11-126047, and JP 11-327509.

Claim 10 depends from claim 1.

Like the other cited references, JP 11-327509 fails to disclose or suggest light sources that are semiconductor light emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of a keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects, as recited by claim 1.

4. Claims 12-15 are patentable over the combination of Thornton, Stanek, and JP 08-148056.

Claims 12-15 depend from claim 1.

The combination of Thornton, Stanek, and JP 08-148056 fails to disclose or suggest light sources that are semiconductor light emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of a keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects, as recited by claim 1.

5. Claim 17 is patentable over the combination of Thornton, Stanek, and JP 08-265413.

Claim 17 depends from claim 16.

None of the cited references disclose or suggest light sources that are semiconductor light emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of a keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects, as recited by claim 16.

6. Claim 18 is patentable over the combination of Thornton, Stanek, and JP 06-274261.

Claim 18 depends from claim 16.

Like the other references, the combination of Thornton, Stanek, and JP 06-274261 fails to disclose or suggest light sources that are semiconductor light emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of a keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects.

7. Claims 19 and 20 are patentable over the combination of Thornton, Stanek, and JP 11-88948.

Claims 19 and 20 depend from claim 16.

Like the other cited combinations of references, this combination fails to disclose or suggest light sources that are semiconductor light emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of a keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects, as recited by the independent claims of the present invention.

8. Claims 21-25 are patentable over Stanek.

Stanek fails to disclose or suggest a keypad for a mobile phone having a layer including a switching function and a layered foil illumination structure for each of the plurality of keys, integrated together, as recited by claim 21.

As mentioned above, in Stanek, the last sentence of column 8 tries to broaden the means for key illumination to include any means by stating that the scope of the patent is not limited to the disclosed examples, but can be used with many "changes and modifications," and may include "other manners of key illumination" without departing from the scope of the claims.

However, in light of Stanek, it would not have been obvious to substitute an OLED for a conventional LED because Stanek has no disclosure related to such a feature. The simple statement: "However, the invention could utilize other manners of key illumination without departing from the scope of the claims" is not enough to suggest Applicants invention as claimed.

Furthermore, the layered foil structures of the present invention and conventional LEDs are not functionally equivalent. As described in the present specification on page 3, line 33, through page 4, line 9, and on page 10, lines 1-8, the layered foil structures have at least the following advantages: they may be placed close to the visible surface of illuminated keys, requiring only a fraction of the power used to drive conventional light sources; because they are thin, they allow the thickness of the keypad to be minimized; and, they may be produced together with other layers in a highly integrated structure. Thus, the layered foils structures are not equivalent to conventional LEDs. Use of layered foil structures is not an obvious design choice and has distinct advantages over the cited art.

Applicants further submit that, similar to the conclusion of obviousness reached above with respect to Thornton, that a conclusion of obviousness using Stanek is based on impermissible hindsight because it requires knowledge gleaned only from Applicants disclosure. There is no disclosure related to semiconductor light emitting devices made of layered foil structures in Stanek.

At least for these reasons, independent claim 21 and dependent claims 22-25 are patentable over Stanek.

9. Claims 26-28 are patentable over the combination of Stanek, Uggmark (US 6,222,466), and Thornton.

Claims 26-28 depend from claim 21.

The combination of Uggmark and Thornton fails to supply the feature missing from Stanek, a switching function and a layered

foil illumination structure for each of the plurality of keys, integrated together, as recited by claim 21.

Therefore, the combination of Stanek, Uggmark, and Thornton fails to disclose all the features of claim 21 and fails to render claims 26-28 unpatentable.

10. Claim 29 is patentable over Stanek.

Stanek fails to disclose a mobile phone having a layer including a switching function and a layered foil illumination structure for each of a plurality of keys, integrated together.

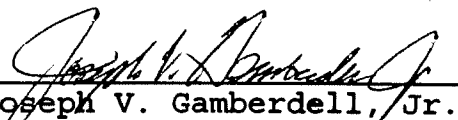
Applicants submit that it would not have been obvious to substitute a layered foil structure for a conventional LED because Stanek has no disclosure related to such a structure. Applicants submit that the claimed layered foil structures and conventional LEDs are not functional equivalents because conventional LEDs have none of the advantages recited above. Further, the statement in column 8, lines 65-67 that the scope of the patent is not limited to the disclosed examples, but can be used with many "changes and modifications," and may include "other manners of key illumination" without departing from the scope of the claims, does not disclose or suggest the layered foil structures of the present invention. Still further, a conclusion of obviousness using Stanek is based on impermissible hindsight because it requires knowledge gleaned only from Applicants disclosure.

It is respectfully submitted that all of the claims, as presented, are clearly novel and patentable over the prior art of

record. Accordingly, the Board of Appeals is respectfully requested to favorably consider the rejected claims and to reverse the final rejections, thereby enabling this application to issue as a U.S. Letters Patent.

A check in the amount of \$500.00 is enclosed herewith for the appeal brief fee. The Commissioner is hereby authorized to charge payment for any additional fees associated with this communication or credit any over payment to Deposit Account No. 16-1350.

Respectfully submitted,


Joseph V. Gamberdell, Jr.
Reg. No.: 44,695

17 January 2005
Date

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VIII. CLAIM APPENDIX

The texts of the claims involved in the appeal are:

1. A keypad for a mobile phone, comprising:

a number of pressable keys,

associated with each key, switching means for realizing a switching function as a response to the key being pressed and

illumination means for illuminating at least a part of the keypad;

wherein:

the illumination means comprise light sources that are semiconductor light-emitting devices made of layered foil structures for dynamically illuminating individual keys or key groups of said keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects,

at least one of said light sources is located in the immediate vicinity of the switching means associated with at least one key,

said light sources constitute at least a first group of light sources and a second group of light sources and

said first and second groups of light sources are arranged to be illuminated separately from each other.

2. A keypad according to claim 1, wherein said light sources are organic light-emitting diodes.
3. A keypad according to claim 2, wherein:

the keypad comprises a printed circuit board so that the switching means comprise conductive patterns close to each other on a surface of said printed circuit board, and

said printed circuit board constitutes a supporting substrate layer for the organic light-emitting diodes.
4. A keypad according to claim 1, comprising:

in respect of each key, a pair of conductive patterns close to each other which together form a key location,

a number of resistive strip sections that link conductive patterns from a number of key locations into a resistive chain having a first end and a second end, and

a number of light sources, each of which is coupled to the second end of said resistive chain so that the second end of said resistive chain functions as a common coupling point to said light sources.
5. A keypad according to claim 4, comprising as many illumination controlling lines as there are light sources coupled to the second end of said resistive chain, each illumination controlling line being coupled to a light source of its own, so that each of said light sources is individually controllable.

6. A keypad according to claim 5, wherein said illumination controlling lines are input voltage lines to the light sources.
7. A keypad according to claim 5, comprising as many switches as there are light sources coupled to the second end of said resistive chain, so that each of said switches is coupled to a light source of its own, and said illumination controlling lines are control voltage lines to the switches.
8. A keypad according to claim 5, comprising a converter for converting illumination commands into controlling signals on said illumination controlling lines.
9. A keypad according to claim 8, wherein said controller is a serial to parallel controller for converting serially conveyed illumination commands into controlling signals on said illumination controlling lines.
10. A keypad according to claim 8, wherein said controller is coupled to a sequence memory and arranged to respond to a certain illumination command by writing a sequence of controlling signals read from said sequence memory onto said illumination controlling lines.
11. A keypad according to claim 1, wherein the illumination means comprise a light source in the immediate vicinity of the switching means associated with each key.
12. A keypad according to claim 1, comprising, in the following order, the following essentially parallel layers:
 - a mechanical support structure,

a dome layer comprising a bulging, elastically deformable conductive dome in respect of each key, the bulging direction of said dome being towards said mechanical support structure,

a printed circuit board so that the switching means comprise conductive patterns close to each other on that surface of said printed circuit board which is towards said dome layer, and

a key layer comprising a visible and touchable surface in respect of each key;

wherein said light sources are located between said printed circuit board and said key layer.

13. A keypad according to claim 12, comprising a perforated insulation layer between said dome layer and said printed circuit board, and an outer cover on a distant side of said key layer.

14. A keypad according to claim 12, wherein said light sources are organic light-emitting diodes placed immediately beneath the visible surfaces of the keys.

15. A keypad according to claim 12, comprising a light guide between said printed circuit board and said key layer.

16. A method for illuminating the keys of a keypad of a mobile phone, comprising the steps of:

providing light sources that are semiconductor light-emitting devices made of layered foil structures as illumination means for dynamically illuminating individual

keys or key groups of said keypad in such a way that the illumination means is reconfigurable for different kinds of illumination effects, and

producing, with at least one of said light sources, an illuminating effect where at least one key is illuminated differently than certain other keys in the keypad.

17. A method according to claim 16, comprising the steps of:

detecting a call connection request indicating the intention of a caller to establish a communication connection with the device controlled through said keypad,

identifying the caller and associating the identified caller with a certain illumination function and

producing, with at least one of said light sources, an illuminating effect representing said illumination function.

18. A method according to claim 16, comprising the steps of:

entering a specific mode where at least one key is more preferable as the key to be pressed next than the other keys in the keypad,

selecting at least one key which in said specific mode is more preferable as the key to be pressed next than the other keys in the keypad, and

producing, with the light source or light sources associated with the selected key or keys, an illuminating

effect which emphasizes the preferability of the selected key or keys over the other keys in the keypad.

19. A method according to claim 16, comprising the steps of:

entering a game mode and allowing the user of the device controlled through the keypad to play a game with the device,

detecting the occurrence of a game event which has previously been associated with an illuminating effect and

generating said illuminating effect with at least one of said light sources.

20. A method according to claim 16, comprising the steps of:

entering a game mode, and

generating, with said light sources, an effect of sequentially illuminating selected ones of the keys in the keypad in order to prompt the user to press the illuminated keys in the same order in which they were illuminated.

21. A keypad for a mobile phone, comprising:

a mechanical support structure;

a plurality of keys; and

a layer including a switching function and a layered foil illumination structure for each of the plurality of keys, integrated together.

22. The keypad of claim 21, wherein the layered foil illumination structures are reconfigurable for different kinds of illumination effects.

23. The keypad of claim 21, wherein the layered foil illumination structures comprise organic light-emitting diodes.

24. The keypad of claim 21, wherein the switching functions comprise organic field effect transistors.

25. The keypad of claim 21, wherein the mechanical support structure comprises a printed circuit board that supports the layer.

26. The keypad of claim 21, wherein:

the switching functions comprise:

a pair of conductive patterns proximate each other which form a key location for each key; and

a number of resistive strip sections that link conductive patterns from a number of key locations into a resistive chain having a first end and a second end, and

the layered foil illumination structures are each coupled to the second end of the resistive chain so that the second end of the resistive chain functions as a common coupling point to the layered foil illumination structures.

27. The keypad of claim 26, further comprising as many illumination controlling lines as there are layered foil illumination structures coupled to the second end of the

resistive chain, wherein each illumination controlling line is coupled to a foil illumination structure so that each of the foil illumination structures is individually controllable.

28. The keypad of claim 26, wherein the illumination controlling lines are input voltage lines to the foil illumination structures.

29. A mobile phone including a keypad, the keypad comprising:

a mechanical support structure;

a plurality of keys;

a layer including a switching function and a layered foil illumination structure for each of the plurality of keys, integrated together.

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